

Development And Implementation Of A Hybrid Intelligent Controller For Interior Permanent-Magnet Synchronous Motor Drives

Uddin, MN; Abido, MA; Rahman, MA

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King Fahd University of Petroleum & Minerals

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Summary

A hybrid neuro-fuzzy scheme for online tuning of a genetic-based proportional-integral (PI) controller for an interior permanent-magnet synchronous motor (IPMSM) drive is presented in this paper. The proposed controller is developed for accurate speed control of the IPMSM drive under various system disturbances. In this work, initially different operating conditions are obtained based on motor dynamics incorporating uncertainties. At each operating condition a genetic algorithm is used to optimize the PI controller parameters in a closed-loop vector control scheme. In the optimization procedure a performance index is developed to reflect the minimum speed deviation, minimum settling time and zero steady-state error. A fuzzy basis function network (FBN) is utilized for online tuning of the PI controller parameters to ensure optimum drive performance under different disturbances. The proposed FBN-based PI controller provides a natural framework for combining numerical and linguistic information in a uniform fashion. The proposed controller is successfully implemented in real time using a digital signal processor board DS 1102 for a laboratory 1-hp IPMSM. The effectiveness of the proposed controller is verified by simulation as well as experimental results at different dynamic operating conditions. The proposed controller is found to be robust for applications in an IPMSM drive.

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For pre-prints please write to: mnuddin@mail.lakeheadu.ca; rahman@engr.mun.ca